2.1 Biodiversity and Evolution – Questions

1. *(a)* Complete the following table, which shows the classification of some organisms, including **two** features only of the phylum where applicable. [9]

Kingdom	*Phylum*	*Features of phylum*	*Class*	*Example*
Animalia	Annelida	1. 2.	Polychaeta	Lugworm *Arenicola marina*
Animalia		Soft moist skin; External fertilisation; Aquatic larvae with gills; Adults simple lungs.		Common frog *Rana temporaria*
Animalia		1. 2.		Desert locust *Schistocerca gregaria*
	Basidiomycota	Hyphae; Cell wall of chitin; Reproduce using spores; No flagella;	Basidiomycetes	Field mushroom *Agaricus campestris*

(b) What is the name of the genus of the Desert locust? [1]

.....

(Total 10 marks)

2.

1. The table below lists five organisms, together with the five kingdoms. Tick (✓) a box to place each organism in the kingdom to which it belongs. [5]

	Plantae	*Animalia*	*Protoctista*	*Fungi*	*Prokaryotae*
Jellyfish					
Yeast					
Amoeba					
Moss					
Bacterium					

(Total 5 marks)

3.

2. *(a)* Which one of the following features, found in two different animals, indicates a common ancestor? [1]
(Tick (✓) your choice.)

Fins of sharks and dolphins. ☐

Wings of birds and bats. ☐

(b) (i) The Galapagos finches illustrate the evolution of different birds from one ancestral form. What name is given to this evolutionary spread of new forms? [1]

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(ii) If a foreign finch was introduced into Britain now, it would be extremely unlikely for it to give rise to a similar variety of descendants to those on the Galapagos. What was different about the situation when the first finches arrived on those islands? [2]

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(c) Why are the Galapagos finches now recognised as separate species, rather than simply varieties of the same species? [1]

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(d) State the best technique for working out the relationships between the descendants of the orignal finch. [1]

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(Total 6 marks)

4. *(a)* To which phylum do mammals belong? [1]

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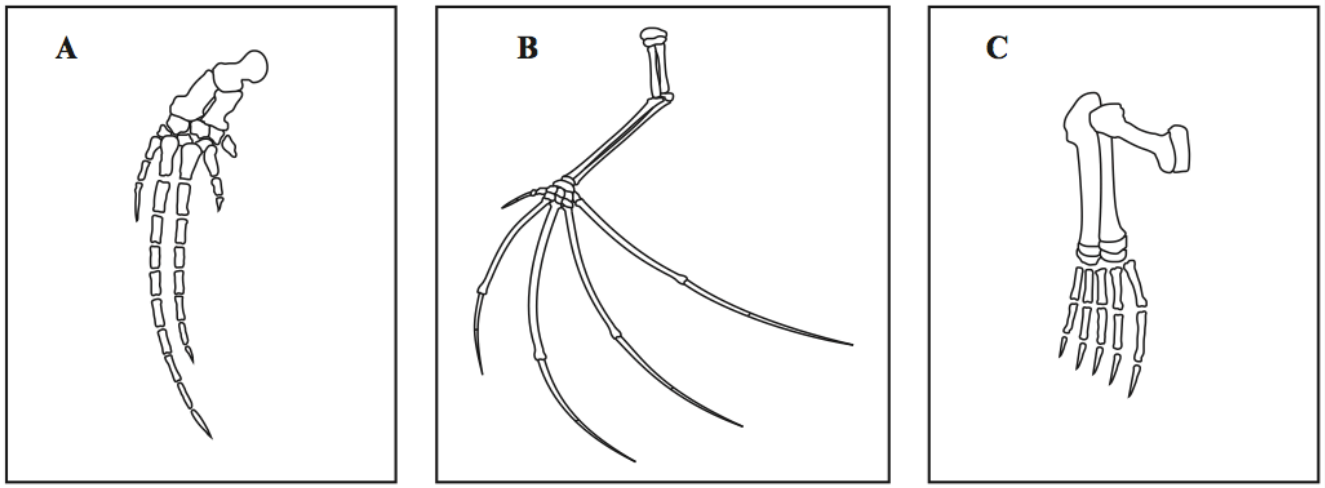
(b) The drawings below show the bones in the limbs of three different mammals.

[not to scale]



Balaenoptera acutorostrata *Macroderma gigas* *Phoca vitulina*

(i) What name is given to limbs with the pattern of bones shown in the drawings? [1]

.....

(ii) Suggest which of limbs **A**, **B** or **C** is best adapted for flight. [1]

.....

(iii) Give the genus of the mammal with limb **C**. [1]

.....

(c) (i) The limbs of these mammals are similar in structure but serve quite different functions. What term is used to describe such structures? [1]

.....

(ii) How are such structures used as evidence for evolution? [1]

.....

.....

(d) The sequence of amino acids in the haemoglobin molecules of the three species has been used to determine their evolutionary relationships. The results below show the same sections of the haemoglobin molecules of the three mammals, each letter represents one amino acid.

M. gigas	....G E E K A A V T G L W G K V N V E.... D S.... S
P. vitulina	....G E E K S A V T A L W G K V N V D.... D S..... S
B. acutorostrata	....A E E K S A V T A L W A K V N V E..... E A.... T

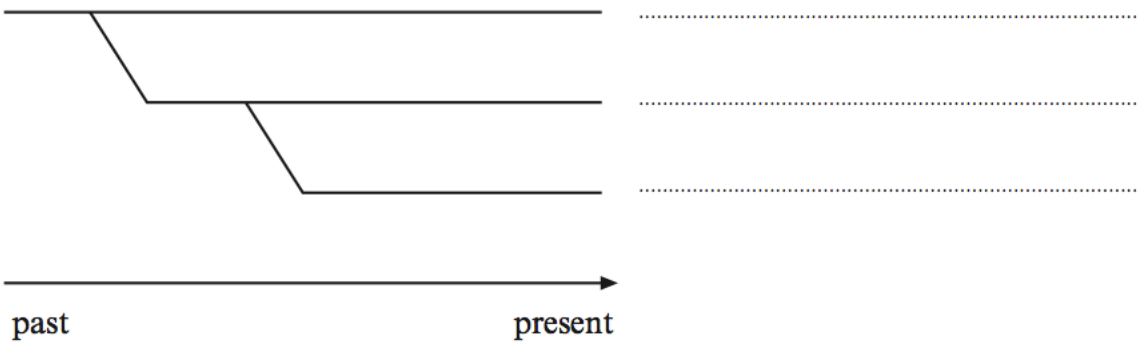
(i) There are 7 differences between *B. acutorostrata* and *M. gigas*.
There are 3 differences between *P. vitulina* and *M. gigas*.
How many differences are there between *P. vitulina* and *B. acutorostrata*? [1]

.....

(ii) Which species is more closely related to *Phoca vitulina*? [1]

.....

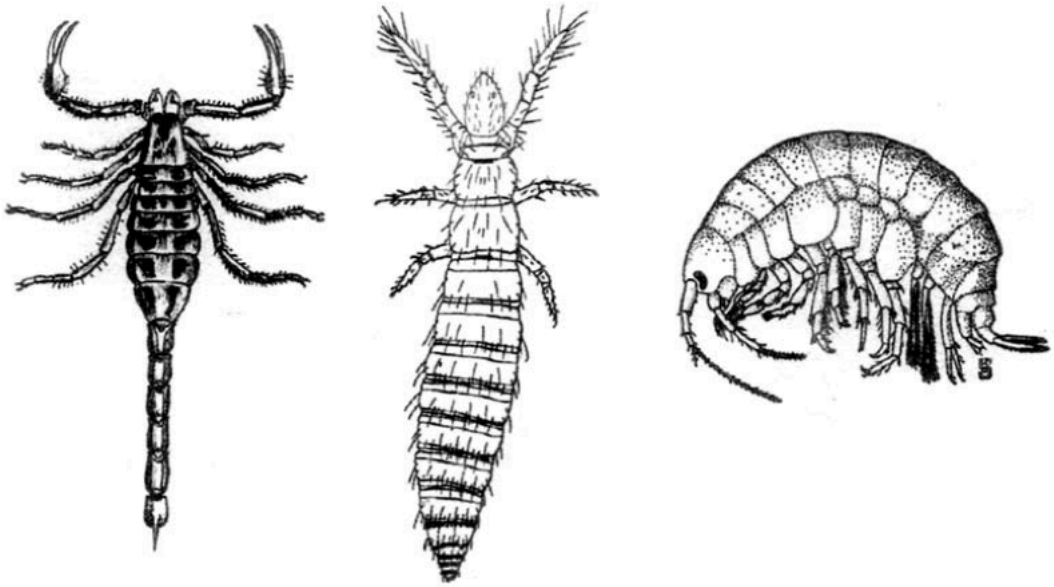
(e) Use your answers to part *(d)* to complete the following (phylogenic) evolutionary tree. [1]



(Total 9 marks)

5.

The animals in the diagram below belong to the phylum Arthropoda.



(a) Apart from having an exoskeleton, name **two** other features **that you can see in the diagram** that members of the Arthopoda have in common. [2]

.....

.....

(b) Give **one** advantage and **one** disadvantage of an exoskeleton. [2]

Advantage .....

.....

Disadvantage .....

.....

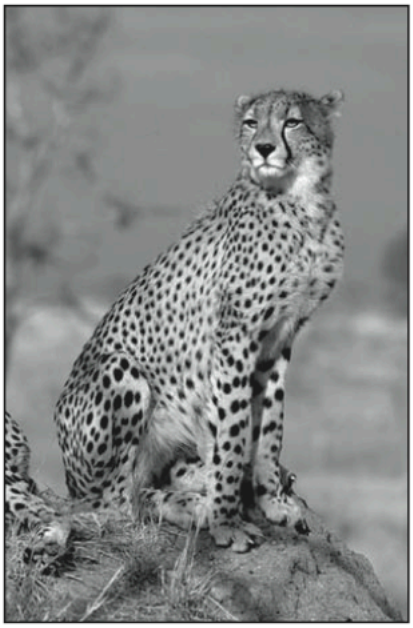
(c) Each of the animals above belongs to one of the four main sub-groups of the Arthropoda. Name the taxonomic level of these sub-groups. [1]

.....

(Total 5 marks)

6.

Twenty thousand years ago, cheetahs *(Acinonyx jubatus)* roamed throughout the savannahs and plains of four continents: Africa, Asia, Europe, and North America.



About 10 000 years ago - because of climate changes - all but one species of the cheetah became extinct. With the drastic reduction in their numbers, close relatives were forced to breed and the cheetah became genetically inbred, meaning that all cheetahs are closely related.

(a) Classify the cheetah. [3]

Phylum .....

Class .....

Genus .....

(b) Name **one** feature that a cheetah has which allows the correct identification of each of its phylum and class. [2]

Feature of the phylum

.....

Feature of the class

.....

(c) The drastic reduction in the numbers of cheetah results in the loss of genetic diversity in the population. What term is applied to this? [1]

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(d) (i) What biochemical method could have been used to determine that all cheetahs are closely related? [1]

.....

(ii) What would the results show? [1]

.....

.....

(Total 8 marks)

7.

The photographs show two species of swallowtail butterfly.

Two-tailed Swallowtail
(*Papilio multicaudata*)

Blue Mountain Swallowtail
(*Papilio ulysses*)

(a) Butterflies belong to the same phylum as lobsters and spiders.

(i) Name the phylum to which these organisms belong. [1]

.....

(ii) Describe **two** features that all members of this phylum have in common. [2]

.....

.....

(b) Based on their physical characteristics the species of butterfly shown above are believed to be closely related. However, the Two-tailed Swallowtail is found in the USA while the Blue Mountain Swallowtail is found in Indonesia. It is possible that these species of butterfly may have become similar in form due to **convergent evolution**.

(i) State what is meant by the term *species*. [1]

.....

.....

(ii) Name the taxonomic **level** which suggests that the butterflies are closely related. [1]

.....

(iii) Identify **one** method that could be used to confirm whether these butterflies are closely related or are the result of convergent evolution. [1]

.....

(iv) Describe how this method would show whether the butterflies are closely related. [1]

.....

.....

(Total 7 marks)

8.

The species is the basic unit by which biodiversity is measured.

(a) Define the term *species*. [2]

.....

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(b) Some data on biodiversity is shown below.

	Estimated number of species		
	Britain	Borneo	World
Latitude (how far North of equator)	53°N	1° N	
Fish (freshwater)	38	394	>8500
Amphibians	6	100	>4000
Reptiles	6	105	6500
Birds (breeding residents)	210	600	9881
Mammals	48	288	4327

(i) Which vertebrate class in the table above shows the greatest biodiversity?

..... [1]

(ii) Using the table above, the percentage of the world's species of reptiles found in Britain was calculated as 0.09%. Calculate the percentage of the world's species of reptiles found in Borneo. [1]

.....

(iii) Describe how the data above confirms the general pattern of biodiversity across the globe, from poles to equator. [1]

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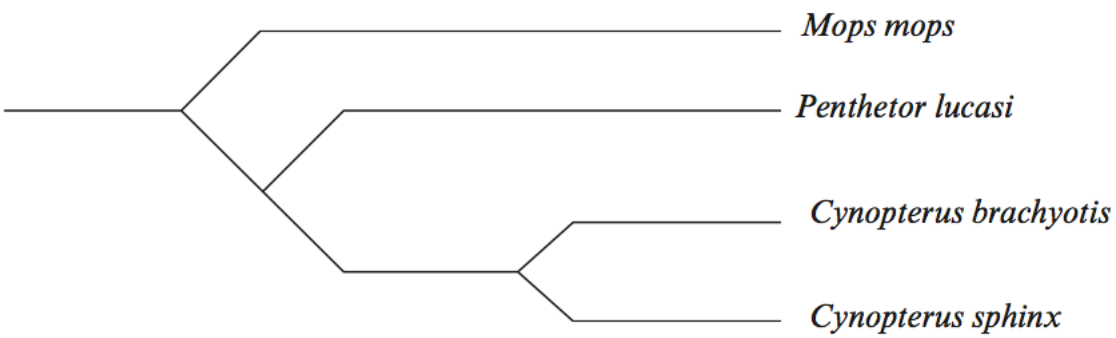
.....

(c) There are 288 species of mammals in Borneo, of which 102 belong to the order Chiroptera (bats). The following diagram is a phylogenic tree showing the evolutionary relationship between some of the bats.



(i) Suggest, by marking an **X** on the phylogenic tree above, the position of an ancestor common to *Penthetor lucasi* and *Cynopterus sphinx* but not common to *Mops mops*. [1]

(ii) What do the latin names of *Cynopterus brachyotis* and *Cynopterus sphinx* tell us about their classification? [1]

.....

.....

(d) The wings of bats show similar morphology to the flippers of seals but have completely different morphology to the wings of insects. State the terms applied to structures that show

(i) common structure but different functions; [1]

.....

(ii) common functions but different structures. [1]

.....

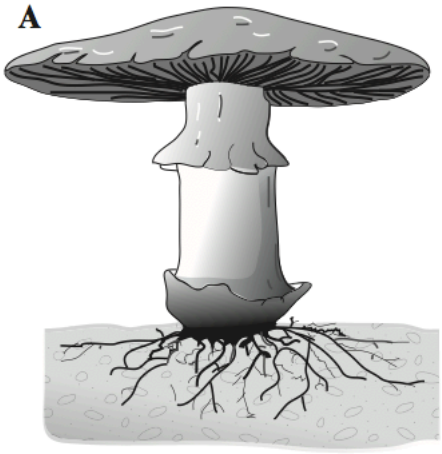
9.

1. *(a)* Complete the table on classification given below. [4]

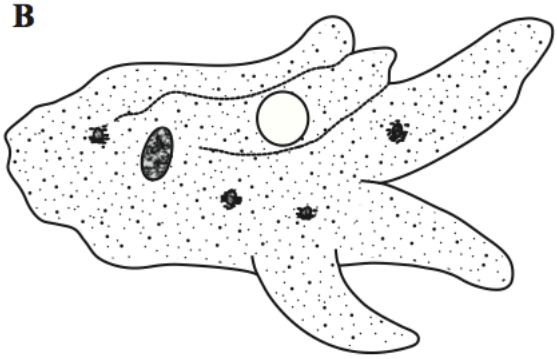
Kingdom	Phylum	Class	Genus
	Angiosperm	Dicotyledons	Ranunculus (Buttercup)
Animalia		Oligochaetae	Lumbricus (Earthworm)
Animalia		Mammalia	Rattus (Rat)
Animalia	Arthropoda		Locusta (Locust)

(b) The diagrams, **A** and **B** below, show two organisms from **two** other Kingdoms *not* given in the table.

A



B



(i) Name the **two** Kingdoms to which the two organisms belong. [2]

A .....

B .....

(ii) State **one** characteristic of each organism which is a feature of its Kingdom. [2]

A .....

B .....

10.

1. The table below shows certain characteristics of four kingdoms. If the characteristic is present in members of the kingdom this is shown with a tick (✓). If the characteristic is not present this is shown with a cross (**X**).

Complete the table below by giving the name of each kingdom. [4]

		Kingdom			
		.....	.....	.....	.....
Characteristic	Eukaryotic	✓	✓	X	✓
	Chloroplast	✓	X	X	some species
	Cell wall	✓	X	✓	some species
	Nucleus	✓	✓	X	✓

only

4

11.

The modern system of classification has five Kingdoms.

(a) Name the five Kingdoms. [2]

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.....

(b) (i) Write the following taxa in order of size starting with the largest group and ending with the smallest group. [2]

order, genus, phylum, class, family.

.....

.....

(ii) Give **one** reason why the tiger is placed in order Carnivora. [1]

.....

(iii) Give **one** reason why the tiger is placed in family Felidae. [1]

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(c) According to the binomial system, the tiger is named *Panthera tigris*.

(i) Which **two** taxa are used in the binomial system to name a particular organism? [2]

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(ii) Why is the binomial system important to the international scientific community? [1]

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(Total 9 marks)

12.

There are seven taxonomic groups used in biological classification. The classification groups of the tiger are listed below but not in the correct sequence.

Number	*Taxonomic group*	*Classification of tiger*
1	genus	Panthera
2	kingdom	Animalia
3	species	tigris
4	class	Mammalia
5	phylum	Chordata
6	family	Felidae
7	order	Carnivora

(a) Using the numbers 1-7, place the taxonomic groups in the correct sequence starting with the highest group. The first one has been done for you. [1]

2						

(b) List the **four** kingdoms that contain eukaryotic organisms. [4]

1. .....

2. .....

3. .....

4. .....

(c) State **three** features of the kingdom prokaryotae. [3]

1. .....

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2. .....

.....

3. .....

.....

(d) Lions and tigers can interbreed together producing offspring. Suggest why lions and tigers are considered as separate species. [1]

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.....

(Total 9 marks)

13.

In Africa, Lake Nabugabob separated from Lake Victoria thousands of years ago.
There are five species of cichlid fish of the genus *Haplochromis* in Lake Nabugabob, each descended from a different species in the main lake, Lake Victoria.

(a) Name the Phylum and Class to which these cichlid fish belong. [2]

Phylum .....

Class .....

(b) Explain why the fish from each lake can be described as different species. [2]

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(c) Suggest how analysis of DNA or proteins might be used to supply additional evidence that the Lake Nabugabob fish have descended from ancestors in Lake Victoria. [2]

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(d) Explain how the splitting of the fish population into Lake Nabugabob and Lake Victoria populations has led to the formation of the separate species. [4]

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(Total 10 marks)

14.

(a) Complete the following table to show the classification of the Tiger, *Panthera tigris*. [6]

Kingdom	Animalia
Phylum	
Class	
	Carnivora
	Felidae
Genus	
Species	

(b) Suggest how DNA data can provide evidence for the evolutionary relationship between organisms. [1]

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(Total 7 marks)

15.

The table below shows the classification of a sample of animals belonging to class Mammalia.

(a) Each column represents a different taxon. Write the names of the taxa in the spaces available at the head of each column. [2]

.....	.....	.....	.....
Carnivora	Canidae	Vulpes	vulpes
Carnivora	Canidae	Canis	lupus
Perissodactyla	Equidae	Equus	zebra
Perissodactyla	Equidae	Equus	asinus
Carnivora	Felidae	Felis	silvestris
Carnivora	Felidae	Panthera	tigris
Artiodactyla	Giraffidae	Giraffa	camelopardalis
Artiodactyla	Giraffidae	Okapia	johnstoni
Primates	Hominidae	Gorilla	gorilla
Primates	Hominidae	Homo	sapiens

(b) (i) Explain what is meant by the binomial system for naming organisms. [2]

.....

.....

(ii) Give the binomial name of the tiger. [1]

.....

(iii) Suggest binomial names for [1]

Zebra, ...

Gorilla. .....

(1)

(c) The diagram below shows the results of tests used to find out how closely related some of the animals are. Samples of ribosomal RNA from the animals were mixed with restriction enzymes, placed in the wells labelled **A**, **B**, **C**, **D**, **E**, and an electrical current applied.

(i) Name this technique. [1]

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(ii) What purpose did the restriction enzymes perform? [2]

.....

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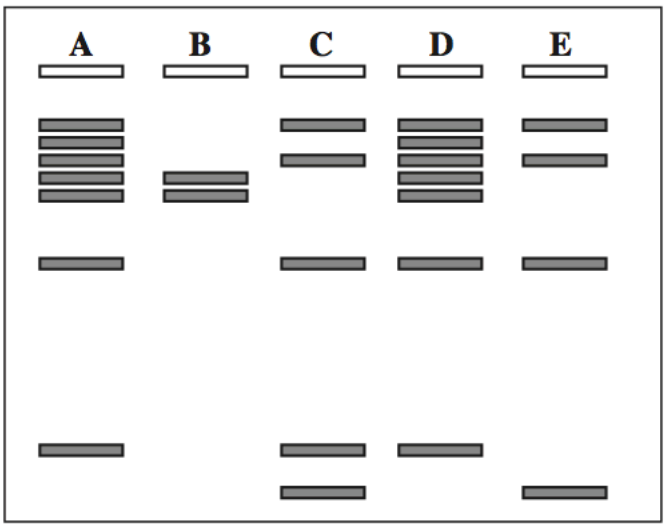

(iii) Which **two** animals in the table opposite are most likely to have provided samples **A** and **D**? [1]

.....

(iv) Explain your answer to part *(c)* (iii). [2]

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(Total 12 marks)

Essays

1.

(a) Describe the theory of evolution, as put forward by Charles Darwin, suggesting any evidence which supports his views. [10]

2.

(b) Describe the five Kingdoms into which all organisms are placed, giving the main features of each Kingdom. [10]